BARÇA SPORTS ANALYTICS SUMMIT

Consiglio Nazionale delle Ricerche

Università di Pisa

BARÇA INNOVATION HUB
Reinventing Sport

Explainable Injury Forecasting via Multivariate Time Series and Convolutional Neural Networks

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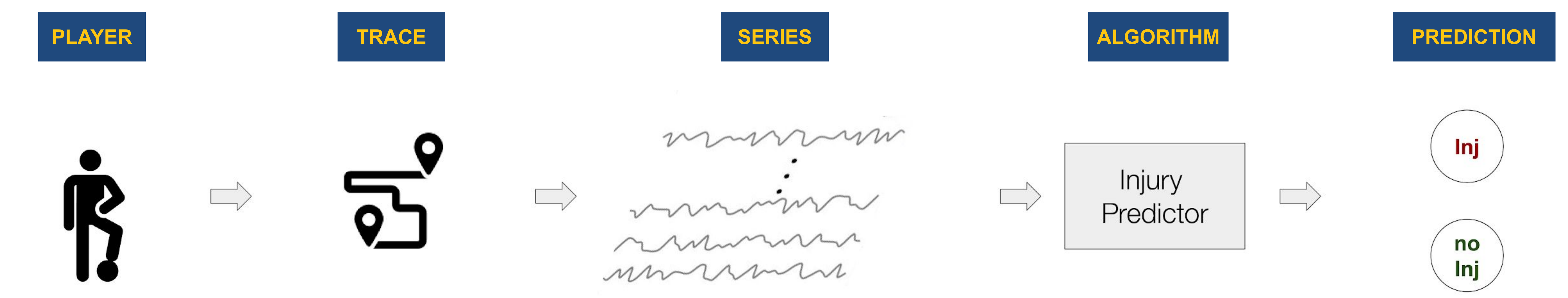
GOAL TO TRAIN AN **INJURY FORECASTER** BASED ON GPS TRAINING FEATURES



each player's training session and match are monitored through a wearable device

the wearable device generates a trace describing the player's movements

the traces are translated into a MTS where each dimension is a measurement of workload

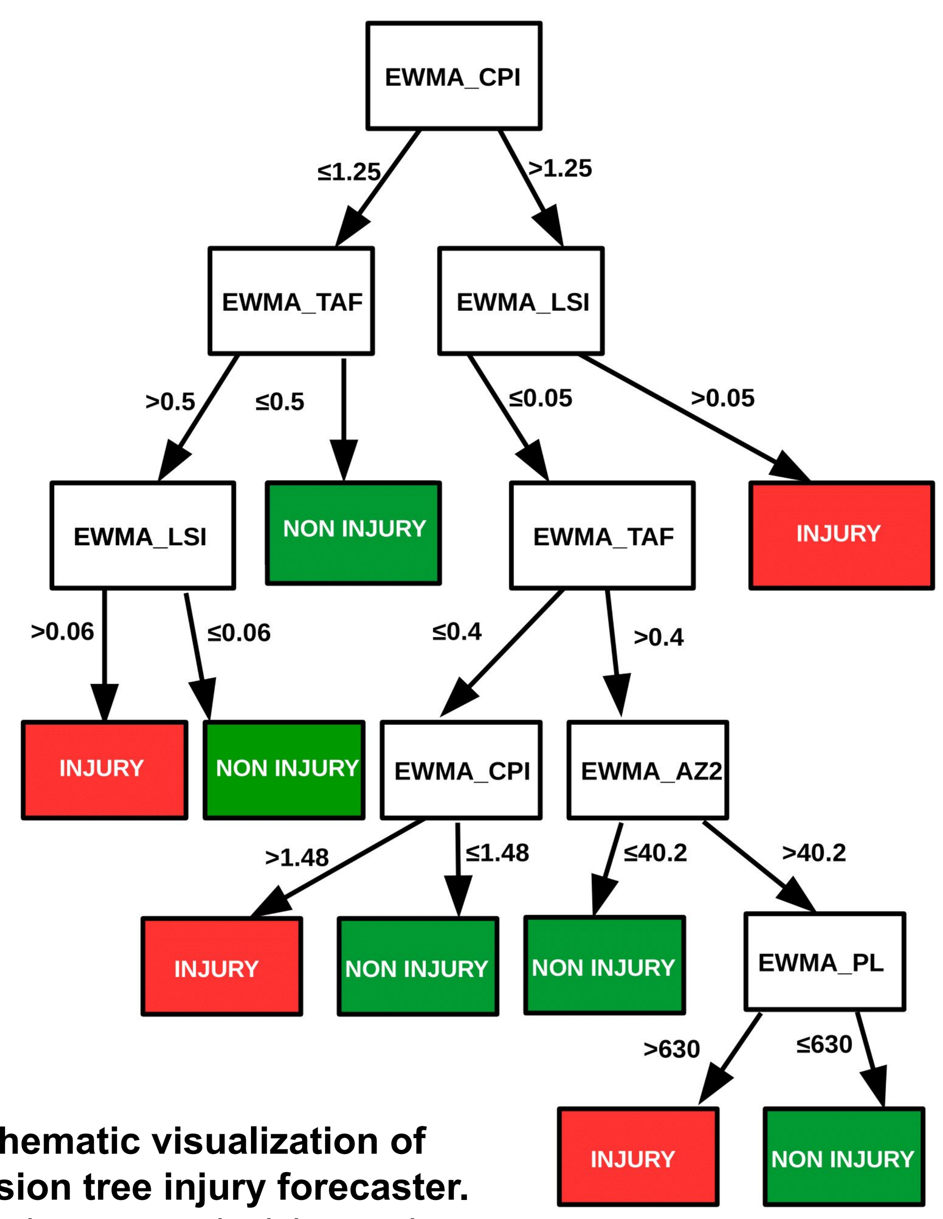
the MTS is given in input to an Injury Predictor algorithm

the injury Predictor makes a prediction about the player's injury likelihood

Decision Tree

EXPLAINABLE ✓

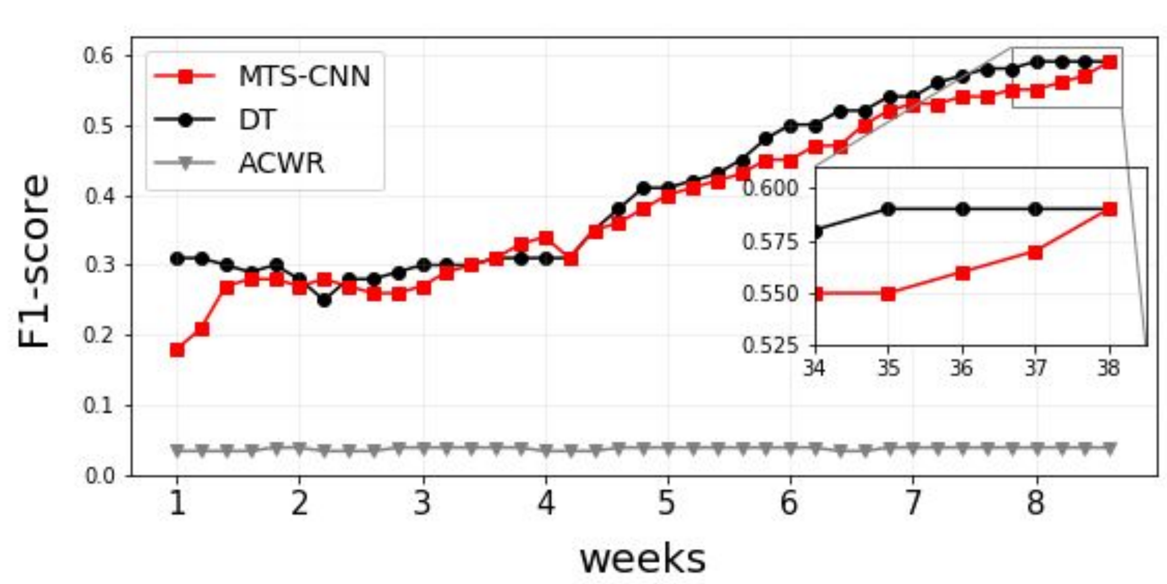
No need for FEATURE ENGINEERING ✗



A schematic visualization of decision tree injury forecaster. White boxes are decision nodes, green boxes are leaf nodes for class No-Injury, red boxes are leaf nodes for class Injury.

PRECISION	50% (4%)
RECALL	80% (43%)

CPI = Previous Injury Count; TFA = Training After Injury; LSI = Injury time series; AZ2 = acceleration above 2m/s²; PL = Player Load.

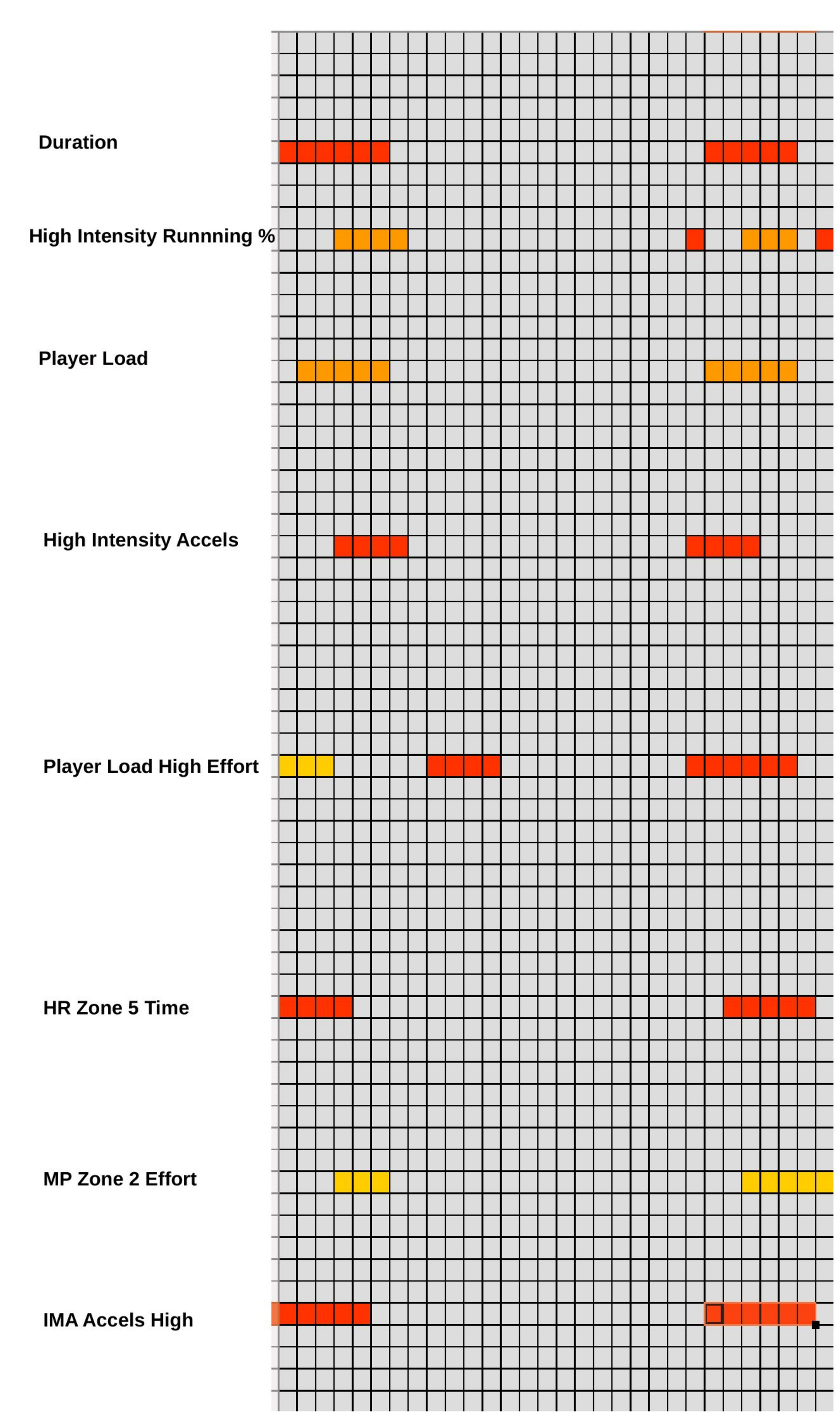


Evolution of the cumulative F1-score of the CNN, DT and ACWR. The inset zooms on the last part of the season.

Convolutional Neural Network

EXPLAINABLE ✓

No need for FEATURE ENGINEERING ✓



Explanation of a correctly classified injury workload history. Rows represent workload features and columns training sessions. Colors are assigned according to how much relevant is a cell to the CNN's decision making (grey no-relevant; yellow not very relevant up to red very relevant).

PRECISION	48% (4%)
RECALL	72% (43%)